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(54) **DEVICE FOR WOUND HEALING BY MEANS OF LIGHT**

**VORRICHTUNG ZUR ÄUSSERLICHEN MEDIZINISCHEN BEHANDLUNG MIT LICHT**

**DISPOSITIF PERMETTANT DE CICATRISER DES BLESSURES A L'AIDE DE RAYONS LUMINEUX**

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(74) Representative: **Örtenblad, Bertil Tore et al**  
**Noréns Patentbyrå AB**  
**P.O. Box 10198**  
**100 55 Stockholm (SE)**

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(73) Proprietor: **BIOLIGHT PATENT HOLDING AB**  
**182 33 Danderyd (SE)**

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(72) Inventor: **THIBERG, Rolf**  
**S-184 50 Akersberga (SE)**

**EP 0 740 567 B1**

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1

EP 0 740 567 B1

2

### Description

[0001] The present invention relates to a device for healing wounds and sores with the aid of light, where, more specifically, the light facilitates healing of the wound or sore and accelerates the healing process.

[0002] It has been found that the treatment of wounds and sores with the aid of light has a favorable effect on the healing process, such as to accelerate healing. This applies to both wounds in the form of continuity interruptions in normal tissue and such sores as pressure sores caused by violence, leg ulcers, burn injuries, etc..

[0003] It has been observed that infrared light has a favorable effect on the healing of wounds and sores.

[0004] Document DE-A-4 143 168 discloses a wound healing device having a light emitting element including infrared and red light emitting diodes, and drive means which cause the light emitting element to emit, for a predetermined time period, and according to therapeutic needs, only infrared light or only red light, wherein the drive means cause the light emitting element to pulsate the emitted light in accordance with a predetermined series of pulse frequencies over said time period.

[0005] The present invention is based on the understanding that light treatment effected by transmitting given light at given time intervals will give a significantly improved effect in the form of a shortened healing time. The present invention enables the time taken to heal a wound or sore to be halved in all essential in comparison with a healing process in which no treatment is given.

[0006] The present invention is defined in claim 1.

[0007] The invention will now be described in more detail, partly with reference to an exemplifying embodiment of the invention illustrated in the accompanying drawing, in which Figure 1 is a block schematic illustrating the device, and Figure 2 is a side view of a light emitting element.

[0008] Figures 1 and 2 illustrate a device for healing wounds and sores with the aid of light, said device including a light emitting element 1 which is intended to be placed against or held close to a wound or sore on the body of an individual. The light emitting element is shown from one side in Figure 2 and from beneath in Figure 1. This member includes a housing 5 which is provided with a transparent plate 6. Beneath the plate 6 there is located a surface 2 in which a number of light emitting diodes 3, 4 or corresponding devices are mounted. Thus, the light emitting diodes are intended to transmit light through the plate 6 when activated, i.e. when supplied with current through a cable 7. In use, the housing 5 is held so that the plate 6 will lie against the part of the body to be treated. The device also includes drive means 8, 9, 10 for driving the light emitting element 1. The light emitting element 1 includes light emitting diodes 3 or like devices which are constructed to emit infrared light. These diodes are marked with solid circles in Figure 1.

[0009] According to the invention the drive means 8,

9, 10 are constructed to cause the light emitting element 1 to emit infrared light in a first stage for a first predetermined length of time, and then to emit visible red light in a second stage for a second predetermined length of time. Visible red light is emitted by means of light emitting diodes 4 or like devices. These devices are marked with hollow circles in Figure 1. It is extremely important that the treatment is carried out in the order infrared light followed by visible light.

[0010] According to the present invention, the drive means 8, 9, 10 are also constructed to cause the light emitting element 1 to pulsate the emitted infrared light and the red light respectively in accordance with a predetermined series of pulse frequencies over the aforesaid time periods.

[0011] The drive means include a computer 8 and associated memory, and drive circuits 9, 10 which are controlled by the computer. These drive circuits 9, 10 are supplied with voltage for powering the light emitting diodes, through conductors 11, 12. One drive circuit, 9, is intended to activate the infrared light emitting diodes 3 and the other drive circuit 10, is intended to activate the red light emitting diodes 4 that emit visible red light. The computer and the drive circuits are of a suitable known kind.

[0012] The infrared light emitting diodes 3 are preferably GaAs-type semi-conductors (Galliumarsenide) which emit light having a wavelength of 950 nanometers. The light emitting diodes 4 which emit visible light are preferably of the GaAs-type which emit light having a wavelength of 660 nanometers.

[0013] According to one preferred embodiment of the invention, the light emitting diodes are present in the light emitting element in such numbers that the infrared light emitting diodes together deliver a light power of 900 milliwatts, while the red light emitting diodes together have a power of 3000 millicandela.

[0014] Mention is made in the foregoing of predetermined lengths of times over which light is emitted at a treatment. According to the invention, these predetermined time periods are approximately of equal duration. Furthermore, the predetermined time period lies in a range of 2-4 minutes, preferably 3 minutes.

[0015] Mention is made in the foregoing of a series of pulse frequencies. According to one preferred embodiment, each series is comprised of three mutually sequential pulse frequencies at which respective light is emitted.

[0016] In summary, this means that there is first emitted solely infrared light, said light being emitted so as to be pulsed in a manner such that there is first emitted light which is pulsed at a given pulse frequency, whereafter the light is emitted while pulsed at a second pulse frequency, and then at a third pulse frequency. Thereafter there is emitted only visible red light, this light being pulsed at a first pulse frequency and then at a second pulse frequency and thereafter at a third pulse frequency.

3

EP 0 740 567 B1

4

[0017] Provided that the predetermined time period is three minutes, infrared light is emitted over a period of three minutes, and is then followed by visible red light over a period of three minutes. Preferably, the duration of each pulse frequency in the series is one minute.

[0018] According to a highly preferred embodiment of the invention, the first series of pulse frequencies is 78 +/- 10 Hz, 702 +/- 20 Hz and 8.58 KHz +/- 100 Hz. The infrared light is thus first pulsed at a pulse frequency of 78 Hz, followed by a pulse frequency of 702 Hz and then at a pulse frequency of 8.58 KHz, whereafter visible red light is emitted in accordance with the same series.

[0019] A typical treatment of a wound or sore is effected by turning the light emitting element to face the wound or sore and infrared light is emitted in accordance with the aforesaid series for a total period of three minutes, whereafter visible red light is also emitted in accordance with said series for a total period of three minutes. Treatment thus takes six minutes. The treatment is repeated from two to three times each week. Typically, the effect of the treatment will be seen after 4-6 treatments.

[0020] According to one preferred embodiment, the infrared light and the red light respectively are emitted in accordance with another pulse frequency series after from 4 to 6 treatments using the aforementioned series. According to this embodiment, the drive means 8, 9, 10 is intended to cause the light emitting element 1 to emit a second series of pulse frequencies, this second pulse frequency series being, 15.6 +/- 3 Hz, 287 +/- 20 Hz and 31.2 +/- 5 Hz. Each type of light is preferably emitted for a total period of three minutes also with this second pulse frequency series.

[0021] In the foregoing, pulse frequency series have been mentioned in which the pulse frequency is given a relatively narrow interval. It is namely important that the pulse frequency is the nominal frequency or very close thereto. However, the aforesaid predetermined time periods can be varied slightly.

[0022] Connected to the computer 8 is a keyboard 13 by means of which relevant series and the duration of said series can be chosen by depressing the appropriate keys. There will preferably be found a number of different preprogrammed treatment programs to choose from. To the computer 8 there is also connected a display 14 which presents desired data, such as the treatment program chosen, the time duration of the series, etc..

[0023] It will be understood that the construction of the light emitting element can be changed, and that the number and the power of the light emitting diodes can also be changed. The control circuit that includes the computer can also be modified.

[0024] The present invention cannot therefore be considered restricted to the aforescribed embodiments, since the variations and modifications can be made within the scope of the following claims.

#### Claims

1. A device for healing wounds and sores with the aid of light, including a light emitting element which is intended to lie against or be held close to a wound or sore on the body of an individual, and drive means for driving the light emitting element, wherein the light emitting element includes light emitting diodes and is constructed to emit pulsed infrared light, the drive means (8, 9, 19) being constructed to cause the light emitting element (1) to only emit infrared light in a first stage for a first predetermined length of time and thereafter to emit only visible red light in a second stage for a second predetermined length of time, the drive means (8, 9, 10) being constructed to cause the light emitting element (1) to pulsate the emitted infrared light and the emitted red light respectively in accordance with a predetermined series of pulse frequencies over said time periods, the predetermined time periods being approximately of mutually equal duration.
2. An arrangement according to Claim 1 wherein the predetermined time periods lie in a range of 2-4 minutes, preferably 3 minutes.
3. An arrangement according to Claim 2, wherein each of said series is comprised of three mutually sequential pulse frequencies at which a respective light is emitted.
4. An arrangement according to Claim 3, wherein a first series of pulse frequencies is 78 +/- 10 Hz, 702 +/- 20 Hz and 8.58 KHz +/- 100 Hz.
5. An arrangement according to Claim 4, wherein the drive arrangement (8,9,10) is constructed to cause the light emitting element (1) to emit a second series of pulse frequencies, the second pulse frequency series being transmitted after the first series has been repeated from four to six times, this second series of pulse frequencies being 15.6 +/- 3 Hz, 287 +/- 20 Hz, and 31.2 +/- 5 Hz.
6. An arrangement according to any one of the preceding claims, wherein the light emitting element (1) includes infrared light emitting diodes (3) which emit light having a wavelength of 950 nanometers.
7. An arrangement according to any one of the preceding claims, wherein the light emitting element (1) includes red light emitting diodes (4) which emit light having a wavelength of 660 nanometers.
8. An arrangement according to Claim 6 or Claim 7, wherein the infrared light emitting diodes (3) together produce a light power of 900 milliwatts and the red light emitting diodes (4) together produce a

5

EP 0 740 567 B1

6

power of 3000 millicandela.

#### Patentansprüche

1. Vorrichtung zum Heilen von Wunden und Entzündungen mit Hilfe von Licht, mit einem Licht emittierenden Element, das dafür vorgesehen ist, an einer Wunde oder entzündeten Stelle am Körper einer Person anzulegen oder angelegt zu werden, und mit einer Antriebseinrichtung zum Antreiben des Licht emittierenden Elements, wobei das Licht emittierende Element Licht emittierende Dioden aufweist und so konstruiert ist, daß es gepulstes infrarotes Licht emittiert, wobei die Antriebseinrichtung (8, 9, 10) so konstruiert ist, daß sie veranlaßt, daß das Licht emittierende Element (1) in einer ersten Stufe für eine erste vorbestimmte Zeitdauer nur infrarotes Licht emittiert und danach in einer zweiten Stufe für eine zweite vorbestimmte Zeitdauer nur sichtbares rotes Licht emittiert, wobei die Antriebseinrichtung (8, 9, 10) so konstruiert ist, daß sie veranlaßt, daß das Licht emittierende Element (1) das emittierte Infrarotlicht und das emittierte rote Licht entsprechend einer vorbestimmten Reihe von Pulsfrequenzen über die genannten Zeiträume pulsierend emittiert, wobei die vorbestimmten Zeiträume etwa gleich lang sind.
2. Anordnung nach Anspruch 1, bei der die vorbestimmten Zeitdauern in einem Bereich von 2 - 4 Minuten, vorzugsweise 3 Minuten liegen.
3. Anordnung nach Anspruch 2, bei der jede der Reihen aus drei aufeinander folgenden Pulsfrequenzen besteht, bei denen ein entsprechendes Licht emittiert wird.
4. Anordnung nach Anspruch 3, bei der eine erste Reihe von Pulsfrequenzen die Frequenzen 78 +/- 10 Hz, 702 +/- 20 Hz und 8.58 KHz +/- 100 Hz enthält.
5. Anordnung nach Anspruch 4, bei der die Antriebseinrichtung (8, 9, 10) so konstruiert ist, daß sie veranlaßt, daß das Licht emittierende Element (1) eine zweite Reihe von Pulsfrequenzen emittiert, wobei die zweite Reihe von Pulsfrequenzen übertragen wird, nachdem die erste Reihe vier- bis sechsmal wiederholt worden ist, wobei die zweite Serie von Pulsfrequenzen die Frequenzen 15.6 +/- 3 Hz, 287 +/- 20 Hz, und 31.2 +/- 5 Hz enthält.
6. Anordnung nach einem der vorhergehenden Ansprüche, bei der das Licht emittierende Element (1) Infrarotlicht emittierende Dioden (3) enthält, die Licht emittieren, welches eine Wellenlänge von 950 Nanometern hat.

7. Anordnung nach einem der vorhergehenden Ansprüche, bei der das Licht emittierende Element (1) rotes Licht emittierende Dioden (4) aufweist, die Licht emittieren, welches eine Wellenlänge von 660 Nanometern hat.

8. Anordnung nach Anspruch 6 oder Anspruch 7, bei der die Infrarotlicht emittierenden Dioden (3) zusammen eine Lichtleistung von 900 Milliwatt und die roten Licht emittierenden Dioden (4) zusammen eine Leistung von 3000 Millicandela erzeugen.

#### Revendications

1. Dispositif permettant de cicatriser des blessures et des plaies à l'aide de lumière, comprenant un élément d'émission de lumière destiné à venir se placer contre ou tout près d'une blessure ou d'une plaie sur le corps d'un individu, et des moyens de commande pour commander l'élément d'émission de lumière, dans lequel l'élément d'émission de lumière comprend des diodes d'émission de lumière et se trouve construit pour émettre de la lumière infrarouge puisée, les moyens de commande (8, 9, 10) étant construits pour amener l'élément d'émission de lumière (1) à émettre uniquement de la lumière infrarouge dans un premier stade pendant une première durée prédéterminée, puis à émettre uniquement de la lumière rouge visible dans un second stade pendant une seconde durée prédéterminée, les moyens de commande (8, 9, 10) étant construits pour amener l'élément d'émission de lumière (1) à pulser la lumière infrarouge émise et la lumière rouge émise respectivement suivant une série prédéterminée de fréquence d'impulsions pendant les périodes de temps de durée prédéterminée, ces périodes de temps prédéterminées étant approximativement de même durée.
2. Dispositif selon la revendication 1, dans lequel les périodes de temps prédéterminées se situent dans une plage de 2-4 minutes, et durent de préférence 3 minutes.
3. Dispositif selon la revendication 2, dans lequel chacune des séries est constituée de trois fréquences d'impulsions mutuellement séquentielles auxquelles une lumière respective est émise.
4. Dispositif selon la revendication 3, dans lequel une première série de fréquences d'impulsions est de 78 +/- 10 Hz, 702 +/- 20 Hz, et 8,58 KHz +/- 100 Hz.

7

EP 0 740 567 B1

8

5. Dispositif selon la revendication 4,  
dans lequel  
le dispositif de commande (8, 9, 10) est construit  
pour amener l'élément d'émission de lumière (1) à  
émettre une seconde série de fréquences d'impul- 5  
sions, cette seconde série de fréquences d'impul-  
sions étant transmise après que la première série  
ait été répétée de quatre à six fois, cette seconde  
série de fréquence d'impulsions étant de 15,6+/-3  
Hz, 287+/-20 Hz, et 31,2+/-5 Hz. 10
6. Dispositif selon l'une quelconque des revendica-  
tions précédentes,  
dans lequel  
l'élément d'émission de lumière (1) comprend des 15  
diodes d'émission de lumière infrarouge (3) qui  
émettent une lumière ayant une longueur d'onde de  
950 nanomètres.
7. Dispositif selon l'une quelconque des revendica- 20  
tions précédentes,  
dans lequel  
l'élément d'émission de lumière (1) comprend des  
diodes d'émission de lumière rouge (4) qui émettent  
une lumière ayant une longueur d'onde de 660 na- 25  
nomètres.
8. Dispositif selon la revendication 6 ou la revendica-  
tion 7,  
dans lequel 30  
les diodes d'émission de lumière infrarouge (3) pro-  
duisent ensemble une puissance lumineuse de 900  
milliwatts, et. des diodes d'émission de lumière rou-  
ge (4) produisent ensemble une puissance de 3000  
millicandela. 35

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EP 0 740 567 B1

Fig. 1

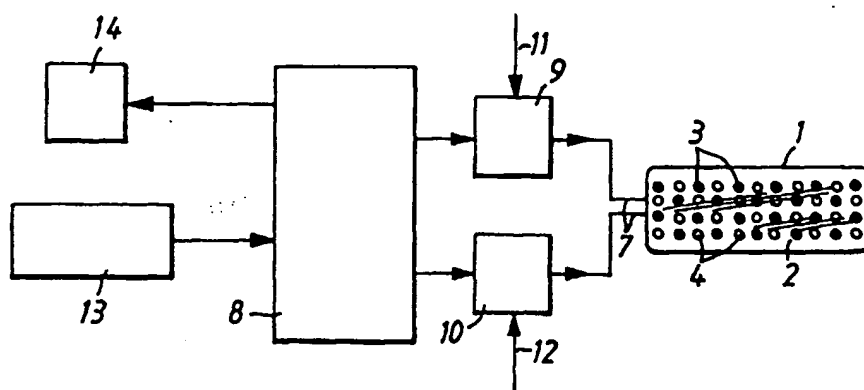
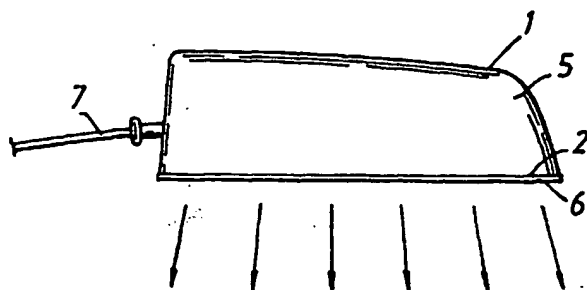


Fig. 2



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